THE INVENTION CLAIMED IS:

1. A method of determining leakage current of dielectric overlaying a semiconductor wafer comprising:

(a) providing a semiconductor wafer having a dielectric overlaying at least part of the semiconductor wafer;

(b) providing a probe having an elastically deformable conductive tip;

(c) causing the probe tip to contact the dielectric;

(d) applying a DC voltage having an AC voltage superimposed thereon between the probe tip and the semiconductor wafer;

(e) sweeping the applied DC voltage having the AC voltage superimposed thereon from a first DC voltage toward a second DC voltage;

(f) acquiring phase angles between the AC voltage and an AC current flowing through the dielectric in response to said AC voltage during the sweep of the DC voltage;

(g) determining from the acquired phase angles, changes in a conductance of the semiconductor wafer and the dielectric as a function of changes in the voltage of the swept DC voltage; and

(h) determining a leakage current of the dielectric from the changes in the conductance.

2. The method of claim 1, wherein step (g) includes:

determining from the phase angles acquired in step (f), changes in a conductance of the semiconductor wafer and the dielectric as a function of changes in the voltage of the swept DC voltage.

3. The method of claim 1, wherein step (h) includes determining the leakage current from the changes in the conductance versus the changes in the voltage of the swept DC voltage.

4. The method of claim 3, wherein step (h) includes determining a slope of the changes in the conductance versus the changes in the voltage of the swept DC voltage for a DC voltage where the semiconductor wafer is in a state of accumulation.

5. The method of claim 3, wherein step (h) includes:

determining a first derivative of the changes in the conductances determined in step (g); and

mathematically combining a voltage where the semiconductor wafer is in a state of accumulation with the first derivative to obtain the leakage current.

6. The method of claim 1, wherein the elastically deformable conductive tip is formed from one of:

a conductive metal;

a conductive elastomer; and

a conductive polymer.

7. The method of claim 1, wherein the AC voltage has a constant amplitude.

8. A method of determining leakage current of a dielectric overlaying a semiconductor wafer comprising:

(a) causing a conductive probe tip to contact a dielectric formed on a semiconductor wafer;

(b) applying between the probe tip and the semiconductor wafer an electrical stimulus that causes the semiconductor wafer to transition between a state of accumulation and a state of depletion, or vice versa;

(c) determining from the applied electrical stimulus, conductance values of the dielectric and the semiconductor wafer; and

(d) determining a leakage current of the dielectric from the conductance values determined in step (d).

9. The method of claim 8, wherein the electrical stimulus includes an AC voltage superimposed on a DC voltage which is swept from a first DC voltage toward a second DC voltage.

10. The method of claim 9, wherein the AC voltage has a constant amplitude.

11. The method of claim 9, wherein the leakage current is determined from a change in the conductance values versus a change in the DC voltage during the sweep thereof.

12. The method of claim 11, wherein the change in the conductance values versus the change in the DC voltage during the sweep thereof is determined at a voltage where the semiconductor wafer is in a state of accumulation.

13. The method of claim 8, wherein the conductive probe tip is elastically deformable.

14. The method of claim 13, wherein the elastically deformable conductive probe tip is formed from one of:

a conductive metal;

a conductive elastomer; and

a conductive polymer.

15. The method of claim 9, wherein step (c) includes:

determining phase angles between the AC voltage and an AC current resulting from applying the AC voltage between the probe tip and the semiconductor wafer during the sweep of the DC voltage; and

determining the conductance values from the phase angles.





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